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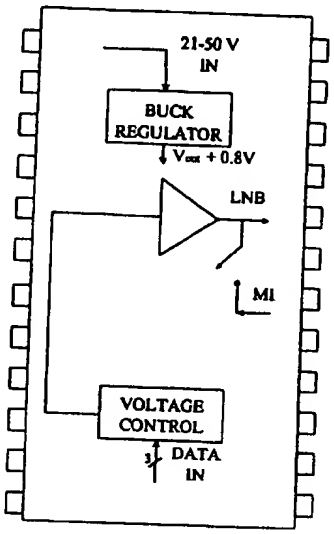
Interim Data Sheet



ABSOLUTE MAXIMUM RATINGS

DC Input voltage	50 V
Output Current	Internally limited
Logic Input Voltage	-0.5 to 7 V
Bypass Switch current	Internally limited
Storage temperature range	-40 to 150°C
Operating Junction Temperature Range	-40 to 150°C

LNB Supply and Control Voltage Regulator

- Short-circuit protected bypass function for slave operation
- LNB selection and stand-by function
- Built-in tone oscillator factory trimmed to 22 kHz facilitates DiSEqC™ encoding
- Full modulation with no load
- Tracking switch-mode power converter for lowest dissipation
- Externally adjustable short-circuit protection
- LNB short-circuit protection and diagnostics
- Auxiliary modulation input
- Cable length compensation
- Internal over temperature protection
- Reverse current protection

Intended for analog and digital satellite receivers, the low noise block converter regulator (LNBR) is a monolithic linear and switching voltage regulator, specifically designed to provide the power and the interface signals to the LNB downconverter via the coaxial cable. If the device is in stand-by mode (EN terminal LOW), the regulator output is disabled. This is to allow the antenna downconverters to be supplied/controlled by other satellite receivers sharing the same coaxial cable. In this mode the device will limit reverse current to 3 mA.

For slave operation in single-dish dual-receiver systems, the bypass function is implemented by an electronic switch between the Master Input terminal (MI) and the LNB terminal, thus leaving all LNB power and control functions to the Master Receiver. This electronic switch is closed if the device is powered and EN terminal is LOW.

The regulator outputs are set to 12, 13, 18, or 20 volts by the VSEL terminals. Additionally, it is possible to increase by 1 V the selected voltage to compensate the voltage drop in the coaxial cable (LLC terminal HIGH).

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The LNBR is a combination of a tracking switching regulator and low-noise linear regulator. Logic inputs (VSEL0, VSEL1 and LLC) select the desired output voltage. A tracking current-mode buck converter provides the linear regulator an input voltage that is set to the output voltage plus typically 0.8 volt. This maintains constant voltage drop across the linear regulator while permitting adequate voltage range for tone injection.

The ENT (Tone Enable) terminal activates the internal tone signal modulating the dc output with a $\pm$ 0.3 V, 22 kHz symmetrical waveform. The internal oscillator is factory trimmed to provide a tone of 22 kHz $\pm$ 2 kHz. No further adjustment is required. The internal oscillator operates the buck converter at 16 time, the tone frequency.

Burst coding of the 22 kHz tone can be accomplished, due to the fast response of the ENT input and rapid tone response. This allows implementation of the DiSEqC™ protocols.

To improve design flexibility and to allow implementation of proposed LNB remote control standards, an analog modulation input terminal is available (EXTM). An appropriate dc blocking capacitor must be used to couple the modulating signal source to the EXTM terminal. If external modulation is not used, the EXTM terminal can be left open.

The output linear regulator will sink and source current. This feature allows full modulation capability into capacitive loads as high as 250 nF.

The programmed output voltage rise and fall times can be set by an internal 50 kΩ resister and an external capacitor located on the TCAP terminal. Although any value of capacitor is permitted, practical values are typically 1 nF to 20 nF. This feature only affects the turn on and programmed voltage rise and fall times. Modulation is unaffected by the choice of TCAP. This terminal can be left open if voltage rise and fall time control is not required.

Two terminals are dedicated to the over-current protection/monitoring: SENSE and OLF. The LNB output is current limited. The short-circuit protection threshold is set by the value of an external resistor, Rsense. Rsense = 0.15/Imax where Imax is the desired current limit. The minimum safe value for Rsense is 0.22 ohm.

In operation, the short-circuit protection produces current fold-back at the input due to the tracking converter. If the output is shorted, the linear regulator will limit the output current to Imax. The tracking converter will maintain a constant voltage drop of 0.8 volts across the linear regulator. This condition results in (Imax)*(0.8 volts) or typically 550 mW dissipation. Short-circuit or thermal-shutdown activation will cause the OLF terminal, an open-drain diagnostic output flag, to go LOW.

The device is packaged in a 24 DIP or an SOIC power-tab package.
Thermal resistance: DIP $R_{\theta JA}$=40°C/W, $R_{\theta JT}$=6°C/W,SOIC $R_{\theta JA}$=55°C/W, $R_{\theta JT}$=6°C/W

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Terminal Configuration

Symbol	Terminal	Function
VINT		Bypass capacitor for internal voltage reference
CPUMP		High side of charge-pump cap
EN		Logic input: enables switcher and outputs
ENT		Logic input: enable internal modulation
EXTM		External modulation input
GND		Ground tabs
VBULK		Tracking supply voltage to linear regulators
LLC		Logic input: increases output voltage by 1 V for line length
Vo		Output voltage to LNB
MI		Master input
LX		Inductor drive point
SENSE		Current limit setup resistor
OLF		Overload flag output
VIN or Vcc		Supply input voltage (range VLNB+2.5 V to 47 V)
VPUMP		Gate supply voltage for high side drivers
PUMPX		Charge-pump drive
TCAP		Capacitor for setting the rise and fall time of the outputs
VSEL0		Logic input: output voltage select
VSEL1		Logic input: output voltage select

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Truth Tables

Control I/O	Terminal Name	L	H
OUT	OLF	Iout > Iomax or Tj > 165°C	Iout < Iomax and Tj < 130°C
IN	EN	Bypass switch closed	LNB ON
IN	ENT	22 kHz tone OFF	22 kHz tone ON

VSEL0	VSEL1	LLC	VLNB (TYP.)
L	L	L	13 V
L	H	L	18 V
L	L	H	14 V
L	H	H	19 V
H	L	L	12 V
H	H	L	20 V
H	L	H	13 V
H	H	H	21 V

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Electrical Characteristics for LNBR Series (T_A = 25°C, ENT=L, EN=H, LLC=L, V_{IN}=24 V, Iout=50 mA (unless otherwise specified).

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit
V_{IN}	V_{CC1} Supply Voltage	I_O=600 mA,VSEL0=L,VSEL1=L, LLC=L	2.5+V o		47	V
V_{O1}	Output Voltage	I_O=600 mA,VSEL0=L,VSEL1=H, LLC=L	17.3	18	18.7	V
		Io=600 mA, SEL0=L,VSEL1=H, LLC=H		19		V
V_{O2}	Output Voltage	I_O=600 mA, VSEL0=L,VSEL1=L LLC=L	12.5	13	13.5	V
		I_O=600 mA, VSEL0=L,VSEL1=L, LLC=H		14		V
V_{O1}	Output Voltage	I_O=600 mA,VSEL0=H,VSEL1=H, LLC=L		20		V
		Io=600 mA, SEL0=H,VSEL1=H, LLC=H		21		V
V_{O2}	Output Voltage	I_O=600 mA, VSEL0=H,VSEL1=L, LLC=L		12		V
		I_O=600 mA, VSEL0=H,VSEL1=L, LLC=H		13		V
ΔVO	Line Regulation	V_O=13 V, V_{IN}=16 to 40 V		4.0	40	mV
		V_O=18 V, V_{IN}=21 to 40 V		4.0	40	mV
ΔVO	Load Regulation	V_O=13 or 18 V, I_O=50 to 600 mA		80	180	mV
SVR	Supply Voltage Rejection	f_{AC}=100 Hz		45		dB
I_{MAX}	Output Current Limiting	Rsense=0.22 ohm	630	680	730	mA
f_{TONE}	Tone Frequency	ENT=H	20	22	24	kHz
a_{TONE}	Tone Amplitude	ENT=H	0.55	0.68	0.8	Vpp
dc_{TONE}	Tone duty cycle	ENT=H	40	50	60	%
t_R, t_F	Tone rise or fall time	ENT=H	5.0	10	15	µs
g_{EXTM}	External modulation gain	$\Delta V_{OUT}/\Delta V_{EXTM}$, f=10 Hz to 40 kHz		1.0		V/V
V_{EXTM}	External modulation input voltage	AC coupling			0.8	Vpp
Z_{EXTM}	External modulation impedance	f=10 Hz to 40 kHz		5.0		kΩ
V_{OL}	Overload flag terminal logic low	I_{OL}=8 mA		0.28		V
I_{OZ}	Overload flag terminal OFF state leakage current	V_{OH}=6 V		< 1.0		µa
V_{IL}	Control input terminal logic low				0.8	V
V_{IH}	Control input terminal logic high		2.0			V
I_{IH}	Control terminals input current	V_{IH}=5 V		< 1.0		µA
I_{CC}	Supply current	Outputs disabled (EN=L)		.5		mA
I_{CC}	Supply current	ENT=H, I_{OUT}=600 mA, V_O=13		382		mA
I_{OBK}	Output reverse current	EN=L, V_{LNBA}=V_{LNBB}=18 V		1.0		mA
		V_{IN1}=V_{IN2}=22 V or floating				
T_{SHDN}	Thermal shutdown threshold			165		°C
ΔV_{BUCK}	Linear regulator voltage drop	V_{BULK} -V_O		0.8		V
f_O	Switching frequency	f_{TONE} * 16	320	352	384	kHz
V_{swil}	Bypass switch current limit	EN=L	630	700		mA
V_{sw}	Bypass switch voltage drop (MI to LNB)	EN=L, I_{SW}=300 mA,		0.15		V